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ABSTRACT

Reported is the development of a Views and Preferences (V & P) instrument for use in tenth grade biology courses to distinguish Inquiry Role Approach (IRA) from non-IRA instructional practices. The V & P instrument was highly related to the IRA materials developed in 1972. Student attitudes toward social interactions, cognitive operations, and teaching procedures in a class were considered in V & P measurements. For each behavior, two items were written, one for V and the other for P measurement. A total of 140 items was developed in forms A and B. The items and their categorizations were judged by 5 judges, and 700 IRA and 520 non-IRA students were used to complete an item discrimination test. The non-IRA group was students enrolled in BSCS biology using a standard text-laboratory approach. Fifty items were proved sensitive to IRA and non-IRA programs and used as items of form C. Most items indicated a difference at levels ranging from 0.001 to 0.2. The authors concluded that V & P instrument form C was applicable to the determination of the degree of implementation of an IRA practice. (CC)

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DEVELOPMENT OF VIEWS AND PREFERENCES C*

INTRODUCTION

In education there appears to be a great need to determine the effects of teacher practices on student outcomes. In order to do this in any systematic manner, consideration should be given to: 1) selecting and specifying the teaching practices, 2) training the teacher to implement the practice, 3) determining to what extent the practice has been implemented in the classroom and 4) determining the effects of the treatment on students.

In conducting studies of this type, one of the most crucial steps that often illudes the investigator is assurance that (3) above has occurred to the extent that the developer will agree that an acceptable level of teacher practice implementation has taken place. It is probably unwise to even try to determine the effects of a treatment that has not adequately or sufficiently been administered. The analogy would be to expect relief from a headache when the directions call for two tablets being taken when, in reality, only a half tablet was taken. In education, the situation has been even more complex and the investigator usually: 1) assumes the treatment variables have been administered properly in the classroom, 2) carries out the implementation practices himself or 3) resorts to some type of monitoring device which is often expensive, impractical and invalid.

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Steele, et. al.,[1] in discussing means of collecting implementation data on classroom activities says:

> "It was judged that the most accurate estimate of cognitive emphasis and positive learning environment could be obtained using sensitive and perceptive observers who would be in the class frequently and who were trained in using systematic procedures to collect the data. This procedure is too costly. The training, time and support demands prohibit its use (not to mention the difficulty of locating qualified personnel willing to do this somewhat unrewarding job). However, two sources of untrained observers exist in any classroom. the teacher and the students."

The experience of the staff of the Mid-continent Regional Educational Laboratory (McREL) has verified these concerns about the use of observers. Additional concerns are whether: 1) the adult observer really sees the classroom practices or transactions in the same way that a majority of students see them and 2) the sample of data received within a short time span can be truly representative of what usually occurs.

The points are not made to negate the importance of the classroom observer or the use of interaction tools. Perhaps we have developed an over-dependence on them as a sole means of collecting data when there are other viable alternatives to be used along with or as a substitute for them. These considerations led the McREL staff to decide to develop the Views and Preferences instrument (Forms A, B and C).

Views and Preferences Form A was developed by McREL staff in 1971 as an instrument somewhat similar to the Biology Classroom Activities Checklist,[2] but somewhat more specific to the social and cognitive classroom practices carried out in the IRA classroom.

The Inquiry Role Approach (IRA) is a student-oriented inquiry program that has been designed to improve the teaching and learning of high school biology. The instructional and curriculum materials, under field test

this year in six states, include instruments especially designed to measure program outcomes. Views and Preferences A was one of these instruments. The V&P instrument was designed to measure both whether the student was aware that the practice had occurred and to what extent he expressed a preference for it. The instrument included 60 items and the students were asked to respond by "strongly agree," "agree," "undecided," "disagree," or "strongly disagree." An example set of items found in this instrument are given as follows:

V. My teacher asks questions that help me think about the evidence I use to support my statements.

P. I prefer ideas to be supported by evidence rather than opinions.

The items on Views and Preferences Form A were validated mainly by opinions rendered by judges who were science educators at McREL or acting as consultants. The test-retest reliability coefficient was computed on a local sample of 141 students and was .80.(3) As the Inquiry Role Approach materials on social roles and open-ended laboratory investigations were developed, there was an increasing need for an instrument to include additional items. In late 1971 the Views & Preferences Form B was developed which included 83 items that were divided into the areas of cognitive operations, social operations and teacher practices. The validity and reliability of the instrument were established much in the same manner as Views and Preferences A. However, as pointed out in the study reported in this conference by Bingman and Steiner,(4) only total scores in each of the three areas were available for comparison with student attitude and cognitive process scores. In 1972 McREL staff decided that the next step in refining and validating the Views and Preferences instrument was to 1) insure that each item discriminated IRA from non-IRA practices

(BSCS biology classes that did not use inquiry roles and especially designed inquiry materials) and 2) establish criteria for each item that would constitute levels of implementation, i.e., adequate, high, very high, etc. Also, the development of Views and Preferences C should consist of items in Views and Preferences A and Views and Preferences B that measure practices that are most highly related to the newly modified IRA materials developed in 1972.

Development of Views and Preferences Form C

Views and Preferences Form C contains 50 items which were selected from Views and Preferences Forms A and B. A copy of this instrument appears in the Appendix. The items were mainly selected on the basis of whether or not they discriminated between 700 IRA students and 520 non-IRA students. Two items, 26 and 36, were rewritten to provide greater clarity. The other 48 were left unchanged. The non-IRA students in this sample were enrolled in BSCS biology classes and used a standard textbook laboratory approach.

The data for the two groups was analyzed by calculating a chi-square for each item. A two (IRA versus non-IRA) by five (strongly agree, agree, undecided, disagree, strongly disagree) contingency table was used with four degrees of freedom. Twenty-eight items indicated a difference at the 0.001 level, nine at the 0.01, three at 0.02, three at 0.05, four at 0.1, two at 0.2 and one was not significant. The non-significant item was retained because the percentage of IRA students responding in the desired direction was in excess of 80% and it was considered an important item to measure one aspect of the IRA program.

The items from Views and Preferences A & B which were not retained were generally not discriminating IRA from non-IRA, the IRA students

were undecided or had an opposite polarity, or the item was judged no longer to be characteristic of an IRA class.

Table 1 lists the 50 items in Views and Preferences - C, the chi-square obtained and the level of significance for four degrees of freedom and a two-tailed test, the percentage of students responding by agreeing or disagreeing and the desired response.

TABLE 1

CHI-SQUARE (LEVEL OF SIGNIFICANCE) OF PERCENT OF STUDENTS CHOOSING DESIRED RESPONSE ON VIEWS AND PREFERENCES FORM C

Chi-Square (Level of Significance) Two-Tailed Test	Item #		Percent Who* Chose Desired Response	Desired Response
21.99 (0.001)	1	IRA N-IRA	66 44	A
69.49 (0.001)	2	IRA N-IRA	82 30	A
12.81 (.02)	3	IRA N-IRA	84 70	A
42.20 (0.001)	4	IRA N-IRA	76 34	A
11.90 (0.05)	5	IRA N-IRA	74 54	A
86.61 (0.001)	6	IRA N-IRA	58 14	D
14.40 (0.01)	7	IRA N-IRA	84 74	D
26.06 (0.001)	8	IRA N-IRA	80 54	A
85.73 (0.001)	9	IRA N-IRA	78 76	A

*The strongly agree and agree or disagree and strongly disagree were added to obtain this percentage. At times there is little difference between IRA and N-IRA and there is a large chi-square and it favors IRA over N-IRA. The reason is in how the percentage was divided between the two categories, e.g., IRA had more strongly agree than agree.

TABLE 1 (Cont'd)

Chi-Square (Level of Significance) Two-Tailed Test	Item #		Percent Who Chose Desired Response	Desired Response
7.82 (0.1)	10	IRA	66	A
		N-IRA	50	
33.72 (0.001)	11	IRA	57	A
		N-IRA	30	
7.90 (0.1)	12	IRA	84	A
		N-IRA	68	
28.10 (0.001)	13	IRA	73	A
		N-IRA	50	
39.05 (0.001)	14	IRA	79	A
		N-IRA	52	
18.96 (0.001)	15	IRA	80	D
		N-IRA	62	
42.55 (0.001)	16	IRA	91	A
		N-IRA	66	
15.36 (0.01)	17	IRA	68	D
		N-IRA	62	
25.28 (0.001)	18	IRA	92	A
		N-IRA	78	
6.09 (0.2)	19	IRA	68	A
		N-IRA	60	
13.61 (0.01)	20	IRA	46	D
		N-IRA	34	
14.64 (0.01)	21	IRA	72	A
		N-IRA	52	
39.40 (0.001)	22	IRA	96	A
		N-IRA	70	
20.39 (0.001)	23	IRA	76	A
		N-IRA	66	
32.58 (0.001)	24	IRA	86	A
		N-IRA	82	
231.27 (0.001)	25	IRA	74	A
		N-IRA	10	

TABLE 1 (Cont'd)

Chi-Square (Level of Significance) Two-Tailed Test	Item #		Percent Who Chose Desired Response	Desired Response
44.19 (0.001)	26	IRA N-IRA	62 62	A
43.53 (0.001)	27	IRA N-IRA	52 20	D
40.74 (0.001)	28	IRA N-IRA	55 28	A
48.77 (0.001)	29	IRA N-IRA	28 6	D
16.32 (0.01)	30	IRA N-IRA	80 62	A
13.43 (0.01)	31	IRA N-IRA	82 56	A
15.55 (0.01)	32	IRA N-IRA	87 55	A
10.32 (0.05)	33	IRA N-IRA	69 59	A
15.54 (0.01)	34	IRA N-IRA	50 24	D
10.48 (0.05)	35	IRA N-IRA	66 46	A
20.80 (0.001)	36	IRA N-IRA	75 52	D
23.77 (0.001)	37	IRA N-IRA	82 62	A
37.68 (0.001)	38	IRA N-IRA	76 40	D
7.88 (0.1)	39	IRA N-IRA	74 68	D
8.61 (0.1)	40	IRA N-IRA	80 66	D
12.07 (0.02)	41	IRA N-IRA	68 46	D

TABLE 1 (Cont'd)

Chi-Square (Level of Significance) Two-Tailed Test	Item #		Percent Who Chose Desired Response	Desired Response
6.24 (0.2)	42	IRA N-IRA	92 78	A
13.02 (0.02)	43	IRA N-IRA	58 40	A
27.30 (0.001)	44	IRA N-IRA	78 60	A
1.42 (N.S.)	45	IRA N-IRA	84 88	A
34.56 (0.001)	46	IRA N-IRA	40 16	A
77.82 (0.001)	47	IRA N-IRA	62 20	D
34.94 (0.001)	48	IRA N-IRA	70 31	D
18.16 (0.01)	49	IRA N-IRA	78 55	A
381.63 (0.001)	50	IRA N-IRA	79 10	D

There are three major sections of Views and Preferences - C:

Section A - Social (16 items 1-16)

Section B - Cognitive (20 items 17-36)

Section C - Class Procedures (14 items 37-50)

The social dimension contains items related to how a student prefers and views interacting with other students in a group or class setting. There are four pairs of items, 2-6, 4-3, 9-7, 10-11, in which a view and then a respective preference is stated. There are eight additional views (four) and preference (four) items which are unpaired.

The cognitive dimension contains items related to how students view or prefer activities related to the text, laboratory, inquiry guides or science in general. There are three pairs of items, 21-17, 25-29, 26-30, in which a view and then a respective preference is stated. There are an additional 14 unpaired items, 10 are views and four are preferences.

The class procedures dimension contains items related to how students view or prefer certain class procedures or teacher practices. There are four pairs of items, 38-39, 40-45, 44-42, 47-46, in which a view and then a respective preference is stated. There are an additional six unpaired items and they are all views. A summary of the information for the three dimensions is shown in Table 2.

Scoring:

Three sections could be given scores ranging as noted below for each:

Section A - 16-80

Section B - 20-100

Section C - 14-70

Undecided scores of 48, 60 and 42 respectively for A, B and C are possible. Scores should significantly exceed these to be meaningful. In fact, more meaning could be obtained by determining what percentage of students have scored in the desired direction and then compare this to the criterion for each item and theme. Theme in this case refers to three arbitrary divisions of the Inquiry Role Approach materials that build on each other during the school year. In Theme I the student is oriented to a complete inquiry cycle. In Theme II the emphasis is on development of inquiry skills and attitudes. In Theme III the student is encouraged to apply them.

TABLE 2

SUGGESTED KEY AND CRITERION LEVEL FOR THE USE OF VIEWS AND PREFERENCES C AT THE END OF THEMES I AND II OF IRA MATERIALS

Item #	Pair	Direction of Response*	View or Preference	Criterion Percentage** End of Theme I	Theme II
Section A (social)					
1	-	A	V	60	70
2	6	A	V	65	75
3	4	A	P	55	65
4	3	A	V	60	70
5	-	A	V	55	65
6	2	D	P	50	60
7	9	D	P	60	70
8	-	A	P	70	70
9	7	A	V	60	70
10	11	A	V	55	60
11	10	A	P	50	55
12	-	A	V	60	70
13	-	A	V	60	70
14	-	A	P	55	65
15	-	D	P	60	70
16	-	A	P	60	70
Section B (cognitive)					
17	21	D	P	50	60
18	-	A	V	65	75
19	-	A	V	50	65
20	-	D	P	50	55
21	17	A	V	55	65
22	-	A	V	60	70
23	-	A	V	55	65
24	-	A	V	55	65
25	29	A	V	55	65
26	30	A	V	50	60
27	-	D	P	50	55
28	-	A	P	50	55
29	25	D	P	50	55
30	26	A	P	55	65
31	-	A	P	55	65
32	-	A	V	55	65
33	-	A	V	50	60
34	-	D	V	50	60
35	-	A	V	55	65
36	-	D	V	55	65

*A = Agree and D = Disagree

**Percentage = total of strongly agree + agree or strongly disagree + disagree

Table 2 (Cont'd)

Item #	Pair	Direction of Response	View or Preference	Criterion Percentage End of Theme I	Theme II
Section C (class procedure)					
37	-	A	V	55	65
38	39	D	V	60	70
39	38	D	P	55	65
40	45	D	V	60	70
41	-	D	V	55	60
42	44	A	P	60	70
43	-	A	V	50	55
44	42	A	V	60	70
45	40	A	P	60	70
46	47	A	P	50	60
47	46	D	V	50	60
48	-	D	V	50	60
49	-	A	V	60	70
50	-	D	V	60	70

Application of V&P (Form C) Key and Criterion Levels to a Sample of IRA Data

Views and Preferences - C has been broken down into 12 areas for further study. The 12 areas are:

	Area	Items
1.	Social - all views items	1, 2, 4, 5, 9, 10, 12, 13
2.	Social - all preferences items	3, 6, 7, 8, 11, 14, 15, 16
3.	Social - paired views items	2, 4, 9, 16
4.	Social - paired preferences items	6, 3, 7, 11
5.	Cognitive - all views items	18, 19, 21, 22, 23, 24, 25, 26, 32, 33, 35, 36
6.	Cognitive - all preferences items	17, 20, 27, 28, 29, 30, 31
7.	Cognitive - paired views items	21, 25, 26
8.	Cognitive - paired preferences items	17, 29, 30
9.	Class Procedure - all views items	37, 38, 40, 41, 43, 44, 47, 48, 49, 50
10.	Class Procedure - all preferences items	39, 42, 45, 46
11.	Class Procedure - paired views items	38, 40, 44, 47
12.	Class Procedure - paired preferences items	39, 45, 42, 46

For each of the 12 areas, four levels have been identified which indicate the extent of implementation of the Inquiry Role Approach program.

	Mean Score* of:
LEVEL 1 - Inadequate implementation (50% or less of the students agree a set of behaviors exists or is preferred).	$\leq$ 3.5
LEVEL 2 - Minimum implementation (51-64% of the students agree a set of behaviors exists or is preferred).	$>$ 3.5
LEVEL 3 - Adequate implementation (65-79% of the students agree a set of behaviors exists or is preferred).	$\geq$ 3.65
LEVEL 4 - Very adequate implementation (80% and above agree a set of behaviors exists or is preferred).	$\geq$ 3.80

* Mean Score: To obtain a score, each student response is assigned a value of 1, 2, 3, 4 or 5, dependent on the preferred response. (If agree is the preferred response, strongly agree = 5, agree = 4, undecided = 3, disagree = 2, strongly disagree = 1. If disagree is the preferred response, strongly disagree = 5, disagree = 4, etc.) The value of student responses for each item are averaged to give a teacher a mean score per item (or per set of items). For example, five students with teacher, Mr. Jones, answer item with respective responses of agree, agree, agree, strongly agree and disagree. If the desired response had been agree, the mean score for the item would be 3.8, and the behaviors of the students in the class having this teacher would have been in Level 4. If the desired response had been disagree, the mean score for the item would be 2.2, and the behavior the item represents would have been in Level 1.

At the end of the first theme (first semester) of the Inquiry Role Approach field test the results shown in Table 3 have been obtained.

TABLE 3

CRITERION LEVELS OF IMPLEMENTATION OBTAINED FOR 12 IRA TEACHERS ON 12 DIMENSIONS OF VIEWS & PREFERENCES - C AFTER THEME 1

Teacher #	Social				Cognitive				Class Procedure			
	AV*	AP*	PV*	PP*	AV	AP	PV	PP	AV	AP	PV	PP
2	4	4	4	4	2	1	1	2	2	4	4	4
3	4	4	4	4	2	1	1	1	3	4	3	4
10	4	4	4	2	2	1	1	2	2	3	3	3
11	2	3	1	2	2	1	2	1	2	4	2	4
12	3	3	3	2	1	1	1	1	1	3	3	3
13	4	4	3	4	2	1	1	1	2	3	4	3
14	1	4	2	3	1	1	1	1	1	3	1	3
20	4	4	4	4	3	1	1	1	4	3	4	3
22	4	4	4	4	3	2	2	3	3	4	4	4
30	4	3	4	1	2	1	1	1	4	4	4	4
31	4	4	4	4	3	3	2	3	3	4	3	4
40	4	4	3	4	2	2	1	4	2	4	2	4

*AV = all views
*AP = all preferences
*PV = paired views
*PP = paired preferences

From the above Table 3 one could quickly determine the number and percent of teachers reaching the various criteria levels for the various dimensions of implementation. For example, only 3 of 12 teachers reached the minimum criterion of 2 for the paired views in the cognitive

area, and the remaining 9 did not reach this level. In contrast, 10 of 12 teachers reached the minimum criterion level or better for the class procedure (AV) dimension. Of course, these results have implications for how well certain aspects of the IRA program were implemented during this theme.

Another usefulness of the Views and Preferences - C is its potential for allowing one to relate these 12 implementation dimensions to each other and to student achievement. Once significant relationships between these implementation dimensions and students' achievements are determined, one can then start to build a case for inclusion or exclusion of these dimensions in teacher training courses.

At the end of Theme I in the IRA program, several instruments are utilized to measure various cognitive and affective behaviors. The ones reported in this study are:

Scale #	Title	Description
* 1.	Biology	Information and definition of terms.
* 2.	Biology	Application and inquiry processes.
3.	Role Responsibilities	Memory test to determine knowledge of the roles in IRA.
4.	Social Skills	Social skills of the IRA program.
5.	Attitudes	A checklist devised to measure certain affective behaviors.
** 6.	EIB-2A	Cognitive inquiry (problem recognition, hypothesizing and search for information).
** 7.	EIB-2B	Cognitive inquiry (study design, data interpretation and synthesis).

* Items for this test were taken from "Resource Book of Test Items" for Biological Science - Second Edition: An Inquiry into Life, Biological Sciences Curriculum Study.

** EIB - Explorations in Biology.

Scale #	Title	Description
** 8.	EIB - Part 2	Searching for information
** 9.	EIB - Part 3	Formulating hypotheses.
** 10.	EIB - Part 4	Designing a study.
** 11.	EIB - Part 5	Interpreting data or findings.
** 12.	EIB - Part 6	Synthesizing knowledge.
*** 13.	DAT (V)	Differential Aptitude Test (Verbal).

Three hundred correlations were calculated and one could expect a certain number to be significant by chance alone. For example:

30 at 0.1
6 at 0.05
3 at 0.01 and
.3 at 0.001

At these respective levels the following results were obtained:

36 (6 more than expected by chance),
29 (23 more than expected by chance),
20 (17 more than expected by chance), and
8 (7.7 more than expected by chance).

The correlations relating dimensions of the V&P - C to four cognitive areas (Nos. 1, 3, 6 and 7) listed on page 14 are reported as examples in Table 4. This table also reports the intercorrelations among the four social areas (Nos. 1-4) and class procedure No. 9 listed on page 11.

** EIB - Explorations in Biology

*** The DAT (V) was given as a pretest and will later be used with the Differential Aptitude Test - numerical as a covariate.

TABLE 4

CORRELATIONS OF V-P (FORM C) SELECTED SOCIAL DIMENSIONS WITH SELECTED COGNITIVE AREAS AND INTERCORRELATIONS OF SELECTED SOCIAL DIMENSIONS

	Cognitive Areas*				Social Areas**		
	1	3	6	7	AV	AP	PV
Social AV	0.59 (NS)	0.36 (NS)	0.22 (NS)	0.31 (NS)	-	-	-
Social AP	0.78 (NS)	0.30 (NS)	0.41 (NS)	0.47 (NS)	0.66 (.05)	-	-
Social PV	0.36 (NS)	0.35 (NS)	0.16 (NS)	0.17 (NS)	0.97(.001)	0.56 (0.11)	-
Social PP	0.81 (NS)	0.16 (NS)	0.24 (NS)	0.38 (NS)	0.62(0.075)	0.89(0.001)	0.48 (NS)
Class Procedure AV	0.09 (NS)	0.54 (NS)	0.52 (NS)	0.65(0.05)	0.68 (.04)	0.24 (NS)	0.66 (.05)
	df=3	df=7	df=3	df=7	df=7	df=7	df=7

* Cognitive Area 1 = Biology information and definition
Cognitive Area 3 = Understanding role responsibilities
Cognitive Area 6 = EIB 2-A
Cognitive Area 7 = EIB 2-B

** Social Area 1 = all views items (see page 11)
Social Area 2 = all preferences items (see page 11)
Social Area 3 = paired views items (see page 11)
Social Area 4 = paired preferences items (see page 11)

Table 4 shows correlations between social dimensions of Views and Preferences (Form C) and certain cognitive areas. Few significant correlations were found in this initial study but the study will be continued when all data are available during interim testing and at the end of the school year. Hopefully, these types of studies will be helpful in indicating which class procedures and practices are related significantly to various types of students' achievement. Once this has been done, then specific comments can be made regarding which class procedures and practices should definitely be included or excluded to reach desired student outcomes.

Further usefulness of the Views & Preferences could be obtained by relating specific items or other sets of items to certain aspects of student achievement.

The development of this instrument and its usefulness in helping to indicate the degree of implementation of a given program (Inquiry Role Approach) has been described. The results of studies in which V&P (Form C) is used can be obtained from the authors as they become available.

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APPENDIX

THE VIEWS AND PREFERENCES OF STUDENTS - FORM C

This is an opinionnaire that asks you to give your honest opinions and preferences about this class and the people in the class. There are no right or wrong answers, just your honest opinions and preferences.

EXAMPLE:

> I find that after a few weeks in the classroom I know everyone much better.

There are five ways you can respond to this statement:

(1) Strongly Agree, (2) Agree, (3) Undecided, (4) Disagree, and (5) Strongly Disagree.

If you agreed with this statement, you could have marked your answer sheet as follows:

	SA	A	U	D	SD
EXAMPLE:	1 ----	2 ■■■■	3 ----	4 ----	5 ----

There are 50 statements on this opinionnaire. To each statement give your honest opinion or preference about this class and activities in class. Mark your opinion or preference on the answer sheet with a pencil.

There are some statements that will be impossible for you to answer because of your inexperience in this classroom. When you are faced with this situation, please respond by marking the space numbered 3 (Undecided).

Some items will ask what you like or prefer. Please indicate what you like or prefer and not what your teacher may like, prefer, or, in fact, grade you on.

REMEMBER:

1. Make no marks in this booklet.
2. All statements should be answered on the answer sheet by blackening in the space to the right of the chosen response in pencil.
3. Please do not write your name on this booklet.

MY VIEWS AND PREFERENCES - C

SECTION A (Social)

1. The teacher uses our ratings and comments to help us improve our team or group work.

2. We help to determine the grades of other team or group members.

3. I would prefer that my team or group members tell me how I am doing than for them to remain silent.

4. We discuss difficulties of our working together as a team or group.

5. In this class, students are expected to express their own opinions.

6. I would rather have the teacher determine all of my grades than to have other students help to determine them.

7. I would rather work alone than share information with others.

8. I am concerned because other students may not help get the team or group work done.

9. In this class we are expected to share information.

10. I think students in this class work well with others to decide what should be done and how to proceed.

11. I prefer that our team or group design our own experiments to answer a question that puzzles us.

12. We work together in teams or groups during each discussion of an Inquiry Guide and Laboratory Explorations in Biology (LEIB).

13. In this class we let others explain and argue points of view.

14. It is more important to me to let others explain and argue points of view than to guess the right answer.

15. I would rather work alone than share work with others.

16. I consider it important to share information.

SECTION B (Cognitive)

17. I would prefer <u>not</u> to investigate questions or problems I raise.

18. We are expected to use material other than the textbook.

19. We discuss and review the problems faced by scientists and other students in their work.

20. I would prefer that scientific conclusions be final and definite.

21. We are given chances to try out a hunch or "good" guess.

22. We are expected to provide evidence to support our position on inquiry statements.

23. The inquiry activities require me to think more as we move along.

24. Our inquiry activities require us to think about things we have learned in other chapters or labs.

25. We are expected to design our own laboratory activities.

26. We spend between one-fourth and one-half of our time doing laboratory work.

27. I prefer tests that require me to recall facts rather than to apply ideas.

28. I would rather complete and discuss an Inquiry Guide than to answer questions at the end of the chapter.

29. I prefer laboratory activities that are designed by someone else.

30. I prefer to spend between one-fourth and one-half of our time in laboratory activities.

31. I would prefer to have my grade based more on the quality of evidence than getting the right answer.

32. I think that science operates in a way that offers chances to try a hunch or "good" guess.

33. I believe the scientific knowledge that I accept as correct will probably change in time.

34. I think science is used to find the <u>right</u> answer rather than a better answer.

35. I understand how this course has helped me think as a scientist thinks.

36. Scientific conclusions appear to me to be final and definite.

SECTION C (Class Procedures)

37. My teacher often asks questions that cause us to think about the evidence that is behind statements made in the textbook or Inquiry Guides.

38. More than one-half of our class time is spent listening to our teacher tell us about biology.

39. I prefer that more than one-half of our class time be spent with the teacher telling us about biology.

40. My teacher doesn't admit his mistakes.

41. My teacher often repeats almost exactly what the textbook says.

42. I like my teacher to encourage us to express our own opinions even when they are different from the teacher's.

43. The teacher answers most of our questions about biology by asking us questions.

44. In this class my teacher encourages students to express their own opinions even when they are different from the teacher's.

45. It is important that the teacher admit his mistakes.

46. I don't like our teacher to give us step-by-step directions as to how to proceed on most activities.

47. Our teacher gives us step-by-step directions as to how to proceed on most activities.

48. More than before, we have to ask the teacher if we are doing the right thing in our experiments.

49. Our teacher allows us to plan and organize our work.

50. My teacher gives step-by-step directions on work we are to do in the laboratory.

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